Digital pH sensors

Category
II 1 G
EPL Ga
CONTENTS

1 Safety instructions ................................................................. 3
  1.1 General notes .................................................................................. 3
  1.2 EU conformity .................................................................................. 3
  1.3 Approval according to the IECEx scheme ........................................ 3
  1.4 Safety instructions ........................................................................... 4

2 Device description ................................................................. 5
  2.1 Device description ............................................................................. 5
  2.2 Description code .............................................................................. 5
  2.3 Marking .............................................................................................. 6
  2.4 Flammable products .......................................................................... 8
  2.5 Device category ................................................................................. 8
  2.6 Protection type for gas hazardous areas .......................................... 9
  2.7 Temperature classes ......................................................................... 9
  2.8 Autoclavability .................................................................................. 9
  2.9 Electrical data .................................................................................. 10

3 Installation .................................................................................. 11
  3.1 Installation .................................................................................... 11

4 Electrical connections ........................................................... 12
  4.1 General notes ................................................................................ 12
  4.2 Power supply ................................................................................ 12
  4.3 Inputs/outputs ................................................................................ 12
  4.4 Grounding and equipotential bonding .............................................. 13

5 Operation .................................................................................. 14
  5.1 Starting up for the first time .......................................................... 14
  5.2 Operation .................................................................................... 14
  5.3 Electrostatic charge ......................................................................... 14

6 Service ..................................................................................... 15
  6.1 Maintenance ................................................................................ 15
  6.2 Dismantling ................................................................................ 15
1.1 General notes

This additional Ex instruction applies to explosion-protected versions of the sensors with the marking II 1 G. It completes the standard documentation for non-explosion protected versions.

The information given in these instructions contains only the data relevant to explosion protection. The technical details given in the standard documentation for the non-explosion protected versions remain unchanged unless they will be excluded or replaced by this instruction.

1.2 EU conformity

The manufacturer declares with the EC declaration of conformity on his own responsibility conformity with the protection goals of directive 2014/34/EU for use in hazardous areas with gas. Conformity with harmonised standards was checked in accordance with EN 60079-0:2012 and EN 60079-11:2012.

The EU declaration of conformity is based on the EC type examination certificate of the Physikalisch Technische Bundesanstalt (PTB):

PTB 13 ATEX 2011 X

You can download the EC Type Examination Certificate from the manufacturer’s website.

1.3 Approval according to the IECEx scheme

Conformity with IECEx standards was tested in accordance with the IECEx Certification Scheme for Explosive Atmospheres acc. to IEC 60079-0:2011 and IEC 60079-11:2012. The number of the IEC certificate is:

IECEx PTB 13.0022 X

You can download the IEC certificate from the manufacturer’s website.
1.4 Safety instructions

If these instructions are not followed, there is a risk of explosion.

Assembly, installation, start-up and maintenance may only be performed by personnel trained in explosion protection!

CAUTION!
Operating conditions and place of installation may require compliance with additional standards, directives or laws. The responsibility for compliance rests solely with the operator or his agent.
### 2.1 Device description

The pH sensor is designed to measure pH in liquids. It has a connection for a 4...20 mA current output with HART® communication. The connection is designed as a plug connector and at the same time supplies the sensor with power.

The PG connection is used as process connection.

![Diagram of pH sensor parts](image)

1. Nickel-plated brass body with VP2 connector
2. PG 13.5 thread
3. Washer
4. O-ring
5. Glass shaft
6. Diaphragm
7. Membrane glass

### 2.2 Description code

The safety description code of the pH sensors is made up of the following elements (spaces in the code may be omitted):

**SMARTPAT PH 8ab0**

<table>
<thead>
<tr>
<th>Feature a</th>
<th>Feature b</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type of diaphragm</td>
<td>Field of application</td>
</tr>
<tr>
<td>a = 1: Open (hole)</td>
<td>b = 2: Industrial wastewater</td>
</tr>
<tr>
<td>a = 3: PTFE</td>
<td>b = 5: Chemical</td>
</tr>
<tr>
<td>a = 5: Ceramic</td>
<td>b = 7: Pharma</td>
</tr>
</tbody>
</table>

Versions available are: SMARTPAT PH 8150, PH 8320 and PH 8570.
2.3 Marking

The marking of the devices in accordance with the description code is shown on the nameplates below. The main plate is on the main part of the device and there is an additional marking on the glass.

Figure 2-1: Position of the nameplates on the sensor
① Nameplate on the sensor connector with ex data
② Marking on the glass

Figure 2-2: Example nameplate ATEX
① Manufacturer
② Device name
③ TAG number, order code, serial number
④ Ex data acc. to PTB 13 ATEX 2011 X
⑤ Manufacturing date
⑥ Electronic/electric device waste marking;
   Observe the operation and installation instruction
SMARTPAT PH 8XXX

DEVICE DESCRIPTION

Figure 2-3: Example nameplate IECEx

1. Manufacturer
2. Device name
3. TAG number, order code, serial number
4. Ex data acc. to IECEx PTB 13.0022 X
5. Manufacturing date
6. Electronic/electric device waste marking;
   Observe the operation and installation instruction

Figure 2-4: Marking on the glass shaft

1. Manufacturer
2. Type
2.4 Flammable products

Atmospheric conditions
An explosive atmosphere is a mixture of air and flammable gases, vapours, mists or dusts under atmospheric conditions. It is defined by the following values:

\[ T_{\text{atm}} = -20 ... +60^\circ C \quad \text{and} \quad P_{\text{atm}} = 0.8 ... 1.1 \text{ bar} \quad \text{or} \quad 11.6 ... 15.9 \text{ psi} \]

Outside of these ranges, for most mixtures no key figures are available for the ignition behaviour.

Operating conditions
Outside of atmospheric conditions, the explosion protection according to ATEX directive – regardless of the zone assignment – is not applicable due to the lack of key safety data.

DANGER!
The operator is responsible to ensure that the sensor is operated safely in terms of temperature and pressure of the products used. In case of operation with flammable media the sensor must be included in the periodic pressure tests of the plant.

2.5 Device category

The sensor is designed in category II 1 G for use in zone 0.

INFORMATION!
Definition of zone 0 according to EN 1127-1:
An area in which an explosive atmosphere, as a result of the mixture of flammable substances in the form of gas, vapours or mist with air, is continuously or for long periods or frequently present.

For more information refer to chapter "Flammable products".
2.6 Protection type for gas hazardous areas

In type of protection "Intrinsic Safety" the sensor meets the requirements of EN 60079-11. The explosion protection is ensured by limitation of the current and voltage so that no ignitable energy can occur.

The marking of the sensor is:

\[ \text{Ex II 1G Ex ia IIC T6...T1} \]

Components of the Ex marking and their definition

<table>
<thead>
<tr>
<th>II</th>
<th>Group II explosion protection</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Equipment category 1</td>
</tr>
<tr>
<td>G</td>
<td>Gas explosion protection</td>
</tr>
<tr>
<td>Ex ia</td>
<td>Intrinsically safe equipment, protection level ia</td>
</tr>
<tr>
<td>IIC</td>
<td>Gas groups IIA, IIB, IIC approved</td>
</tr>
<tr>
<td>T6...T1</td>
<td>Temperature class range T6...T1</td>
</tr>
</tbody>
</table>

2.7 Temperature classes

The permissible temperature range depending on the temperature class of the sensor is:

<table>
<thead>
<tr>
<th>Temperature class</th>
<th>Permissible ambient or product temperature in [°C]</th>
<th>Permissible ambient or product temperature in [°F]</th>
</tr>
</thead>
<tbody>
<tr>
<td>T1</td>
<td>-10...+85°C</td>
<td>14...+185°F</td>
</tr>
<tr>
<td>T2</td>
<td>-10...+85°C</td>
<td>14...+185°F</td>
</tr>
<tr>
<td>T3</td>
<td>-10...+85°C</td>
<td>14...+185°F</td>
</tr>
<tr>
<td>T4</td>
<td>-10...+85°C</td>
<td>14...+185°F</td>
</tr>
<tr>
<td>T5</td>
<td>-10...+55°C</td>
<td>14...+131°F</td>
</tr>
<tr>
<td>T6</td>
<td>-10...+55°C</td>
<td>14...+131°F</td>
</tr>
</tbody>
</table>

The permissible product temperature range can vary depending on the sensor used. Consult the standard documentation for this information.

2.8 Autoclavability

To kill off germs, the sensor may be stored in the autoclave at 140°C / 284°F for 20 minutes.

**INFORMATION!**

The sensor is not operated in the autoclave. For more information consult the standard documentation.
2.9 Electrical data

Connect the sensor only to intrinsically-safe certified circuits. Observe the following maximum values for the sensor when connecting:

- $U_i = 30 \text{ V}$
- $I_i = 120 \text{ mA}$
- $P_i = 1.0 \text{ W}$
- $L_i = 10 \text{ } \mu \text{H}$
- $C_i = 5 \text{ nF}$

**CAUTION!**
Capacity and inductance of the connecting cable have to be considered.

**INFORMATION!**
For information about nominal data and the HART interface consult the standard documentation.

The internal electrode circuit is limited to the following maximum values:

- $U_o = 7.8 \text{ V}$
- $I_o = 10 \text{ mA}$
- $P_o = 20 \text{ mW}$
3.1 Installation

Mounting of the sensor

- Ensure that you use a gasket suitable for the dimensions of the process connection and the requirements of the measuring point.
- Align the gasket correctly.
- Carefully lower the sensor into the provided assembly and afterwards into the tank or the pipe.
- Observe all the relevant regulations.

**DANGER!**
The manufacturer is not liable for any damage or injuries resulting from improper use or use other than the intended purpose. This applies in particular to hazards due to insufficient corrosion resistance and suitability of the materials in contact with product.

**DANGER!**
Installation and setup must be carried out according to the applicable installation standards (e.g. EN 60079-14) by qualified personnel trained in explosion protection. Observe the information contained in the manuals and the supplementary instructions. The installation must always comply with the following requirements:

- No external forces are affecting the sensor.
- The device is accessible for any necessary visual inspections and can be viewed from all sides.
- The nameplate is clearly visible.
- All gaskets are suitable for the intended use.
4.1 General notes

In order to avoid risks, always observe the following points when electrically connecting a sensor:

- Ensure that all connecting cables conform to the valid installation standards (e.g. IEC 60079-14) and withstand the maximum operating temperature.
- Securely lay the connecting cables and sufficiently protect them against damage.
- Securely connect all the cores not in use with the ground potential of the explosive area or carefully insulate them from each other and from ground (test voltage $\geq 500V_{eff}$).

**INFORMATION!**
When connecting the sensor cable, observe the standard documentation for the sensor, the chapter “Installation”.
When using junction box SJB 200 W-Ex, the corresponding handbook must also be observed.

4.2 Power supply

The sensor does not require a separate power supply. The required supply for the electronics is provided via the 4...20 mA current output.

4.3 Inputs/outputs

The connector pin assignment of the sensor is described in the standard documentation. The signal circuits of the sensor may only be connected to certified intrinsically safe slave units or circuits. For more information refer to chapter “Electrical data”.
4.4 Grounding and equipotential bonding

To dissipate dangerous electrostatic charges the metal housing must be grounded. When installing in pipes or vessels that are grounded, the electrical connection to earth is carried out via the PG screw connection made of electrically conductive PEEK or metal (SMARTPAT PH 8570).

If installing in pipes or vessels that are not grounded, the shield of the sensor cable must be connected to the ground potential. The electrical connection to the metal housing and the ground is made by the sensor cable with the VP connector.

**WARNING!**
*The cable shield must not be connected directly on both ends to the ground potential, since unacceptably high equalizing currents can cause an explosion.*

When using junction box SJB 200 W-Ex, the shield of the sensor cable must be connected to the shield connector provided for all SMARTPAT PH 8xxx. This will ensure sufficient electrostatic grounding and at the same time prevent unacceptably high equalizing currents.

**INFORMATION!**
*On junction box SJB 200 W-Ex, the shield connector is connected to the ground potential via a 1 megohms resistor and a capacitor in parallel. The connections for the intrinsically safe 4...20 mA sensor circuit are galvanically isolated from both the electrode circuit and the ground and can be considered ground-free [test voltage 500 Veff]. It is accepted that the electrode circuit can be directly connected to the ground potential.*
5.1 Starting up for the first time

To avoid injury and material damage, only operate the sensor under the following conditions:

- The equipment has to be installed and connected in accordance with the manufacturer’s instructions.
- At the operator’s request, a check was conducted prior to start-up to ensure the correct installation and connection.
- The check prior to start-up was in compliance with the national regulations for checks before start-up.

**INFORMATION!**
Observe the information regarding calibration in the standard documentation.

5.2 Operation

To avoid injury and material damage, only operate the sensor under the following conditions:

- Temperatures, pressures and electrical limit values are in the manufacturer’s specified range.
- The equipment parts necessary for safety are effective in the long run, never disable them during operation!
- Include the sensor in the periodic pressure tests of the plant when operating with flammable products.

**CAUTION!**
When using the sensor, and in particular after connecting the connector, ensure that it is connected properly. Otherwise, the degree of IP protection is not guaranteed.

5.3 Electrostatic charge

In order to avoid ignition hazards due to electrostatic charge, the sensors may not be used in areas where:

- processes that generate strong charges,
- mechanical friction and cutting processes,
- spraying of electrons (e.g. in the vicinity of electrostatic painting systems),
- dust carried by compressed air.
6.1 Maintenance

For systems in hazardous areas, regular checks are required in order to maintain the proper condition. The manufacturer recommends the following maintenance measures:

- Check the housing, the cable entry and the feed lines for corrosion and/or damage.
- Check the process connection and the piping connections for leakage.
- Check the entire sensor for dust deposits.

**CAUTION!**

*Maintenance measures of a safety-relevant nature within the meaning of explosion protection may only be carried out by the manufacturer, his authorised representative or under the supervision of authorised inspectors.*

6.2 Dismantling

In order to prevent injury or material damage when replacing the sensor, always observe the following points:

- Before dismantling the electrical connecting lines of the device, ensure that all the cables leading to the sensor are de-energised themselves and to the reference potential of the explosive area.
- All the relevant process pipes or containers must be depressurised before dismounting the sensor.
- If the process pipes or the container contain products that are harmful to the environment or to health, implement the appropriate safety measures before dismantling the sensor.
- Replace all the seals when reinstalling the device in the process pipe or container.
KROHNE – Process instrumentation and measurement solutions

- Flow
- Level
- Temperature
- Pressure
- Process Analysis
- Services

Head Office KROHNE Messtechnik GmbH
Ludwig-Krohne-Str. 5
47058 Duisburg (Germany)
Tel.: +49 203 301 0
Fax: +49 203 301 10389
info@krohne.com

The current list of all KROHNE contacts and addresses can be found at: www.krohne.com